December 2015
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MPA Materials Matter

INSIDE

Above, the video being shown at the MRS Fall Meeting in Boston. In the image, Nathan Mara describes his nanocomposite research.

At right, still images of Millie Firestone and Jennifer Hollingsworth at the Center for Integrated Nanotechnologies.

Shining a spotlight on Los Alamos's materials science

Movie on Lab's materials research shown at MRS Fall Meeting and Exhibit

The 2015 Materials Research Society Fall Meeting and Exhibit in Boston featured a new venue for the accomplishments of Los Alamos's materials scientists.

In addition to invited talks and poster presentations, the annual meeting and symposium included a five-minute movie, filmed at Los Alamos, showcasing Materials Science and Technology and Materials Physics and Applications division scientists discussing their work. MST Division Leader David Teter narrated the video, highlighting the Lab's mission of national security science and the opportunities available to early-career researchers.

The movie was shown in high-visibility locations including throughout the conference convention center, on conference hotel television channels, the MRS conference website, and YouTube. The MRS fall meeting draws on average 6,000 attendees, more than half of which are from the United States.

John Carpenter and Amy Clarke (Metallurgy, MST-6) brought viewers into the lab, introducing them to Los Ala-

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From Mike's desk . . .

"

. . . it is worth asking what an MPA-centric Purpose Statement would look like. It would certainly share many of the components of the institutional Purpose Statement ("scientific," "tenacious," "trusted," "innovative," "passionate"), but would emphasize a few key points that best exemplify our workforce . . .

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The Los Alamos Purpose Statement that Charlie McMillan and our associate directors have shared with the Lab workforce constitutes a unique mechanism to discuss our institutional values, beliefs, and goals in an interactive manner. The town hall meetings that our ADs hosted were particularly effective in allowing our senior managers to dialogue with the workforce. I had the opportunity to attend four of Mary Hockaday's Purpose meetings and I found them to be a unique experience. Hearing the way in which MPA employees responded to the elements associated with the Purpose Statement (our character, beliefs, spirit, dream, and focus) was particularly informative. While some of these conversations centered on semantics and the sometimes divergent opinion of what particular words mean to different individuals, it was certainly good to see that science is valued and a prominent component of the discussion.

As befitting an organization that is home to research that spans the gamut from fundamental to use-inspired, there was much discussion at the Purpose meetings regarding MPA's connection to the broader Los Alamos national security mission. A number of important points were made regarding this concern. First, MPA's fundamental materials research is clearly very relevant to our DOE Basic Energy Sciences (BES) sponsor as this work supports both our core BES programs and our Center for Integrated Nanotechnologies user facility. The same is true regarding the relevance of the materials research conducted through our National High Magnetic Field Laboratory program that is sponsored by the National Science Foundation. The wide range of applied energy programs being conducted in MPA also strongly connects to the Lab's mission in energy security. Taken together, these efforts have high visibility outside the Lab through the multitude of peer-reviewed publications that MPA produces each year. The many dozens of invited talks and plenary presentations that MPA researchers present at international meetings are also extremely important in publicizing the broad spectrum of research conducted at Los Alamos. These efforts benefit the Lab's mission interests in two important ways. First, they display to the world that Los Alamos National Laboratory research is of extremely high quality and, by inference, the close-hold work that is not publicized can be assumed to be of comparable quality. Second, our highly visible research attracts exceptionally talented postdocs, technicians, and technologists and by doing so ensures that we have a healthy pipeline that will produce our much-needed future workforce. Indeed, we have many recent examples of MPA postdocs that joined PADWP organizations upon completion of their postdoctoral appointments. Hence, success in our more fundamental research endeavors is relevant, directly and indirectly, to Los Alamos's efforts in national security.

Getting back to the Laboratory's Purpose Statement—it is worth asking what an MPA-centric Purpose Statement would look like. It would certainly share many of the components of the institutional Purpose Statement ("scientific," "tenacious," "trusted," "innovative," "passionate"), but would emphasize a few key points that best exemplify our workforce: we are definitely passionate about our science; we thrive on the challenges inherent in a difficult research problem; we work most effectively when part of a multidisciplinary team; we support diversity that takes on many forms; we are recognized both within the United States and internationally as scientific leaders; and we strive to develop the scientific workforce of the future through committed mentoring. MPA personnel are also exceptionally self-motivated, extremely dedicated, and are never bashful when it comes to sharing their opinion or concerns regarding most any topic of relevance to Los Alamos National Laboratory. These are the attributes that make MPA such a vital and exciting organization to be a part of. In closing, I want to encourage everyone to strive to do their best to support the scientific and engineering goals of MPA and Los Alamos, to engage your group and division management when something concerns you regardless of its nature—operational, safety, research, programmatic, strategic, tactical, or a personal issue—and to know that your presence at the Lab matters to the success of our research endeavors.

Acting MPA Division Leader Mike Hundley

From Andrew's desk . . .

I wanted to write a "From the Desk" note about change at Los Alamos National Laboratory. In particular, as 2015 comes to an end, I decided to reflect on my past three years as a group leader in MPA Division, which have been marked by change. It is hard for me to believe that more than two years have already passed since MPA Division decided to combine the Materials Synthesis and Integrated Devices group (MPA-MSID) with the Sensors and Electrochemical Devices group (MPA-11) into a new MPA-11 group that I would lead. Looking back, I am pleased to write that I believe the merger has been a success for the organization.

The process to merge the two groups involved numerous discussions with the staff in both groups and the MPA Division Office. We held several open meetings to listen to individual concerns and address questions about a possible group merger. As you might imagine, opinions about the merger ranged from "no big deal" to "strong reservations." Our conversations allowed us to carefully consider and discuss the potential organizational benefits a merger could have on individuals as well as the Division. Among our concerns was how effectively the larger MPA-11 group could be managed due to the multiple sites where research was being performed.

At the management level we thought a group merger could be successful because both groups had an emphasis on applied energy research programs. We also believed there was potential for developing new collaborative research projects between staff in a larger group that might help expand and diversify our funding portfolio, which was needed. Lastly, I believe, we thought that while a merger would be a significant change and risk for the Division, if it did not work out, we could break the groups apart again, i.e., the decision was not irreversible. For these reasons (and probably some others I have forgotten), MPA decided to combine the two groups.

We immediately set out to address the concerns raised by staff during our initial discussions. We moved the group leader's office to SM-40, which is where half of the newly formed group is located. The other half of MPA-11 is spread out among various sites, so this move made sense to me. We also instituted a management model where the new group would have two half-time deputies to support the other sites. I initially relied on senior scientists, including Rod Borup and Brian Scott, who took on leadership roles and helped advise me through the transition. Jeff Willis was then relatively quickly (within a few months) named one of MPA-11's deputy group leaders. He remains an integral part of our management team today. We then ran a search for the second deputy that identified George Goff as the best fit for the new group. George has now been with MPA for just over a year. He has been a significant factor in our ability to expand the funding portfolio in MPA-11.

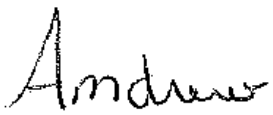
Over the last two years I have seen dramatically increased interactions between staff who were in the separate groups. We have been able to integrate talented people into existing programs and we have gotten people to think about utilizing capabilities in new ways. Several new programs have indeed been developed because of the interactions among the newly combined staff. Our funding portfolio has changed over this time, as well. While MPA-11 remains committed and focused on our core scientific research programs, like fuel cells, we have found ways to utilize our expertise to solve challenging problems for NNSA programs at Los Alamos. MPA-11 continues to look for ways to broaden our funding portfolio and become better integrated with NNSA programs, which we believe will give us more flexibility and funding certainty in the coming years.

In summary, there have been a number of changes in our organization over the last few years, but the staff and management throughout the division have acted proactively in our changing environment. The organizational changes that we initiated a few years ago brought about several new programmatic opportunities for our group and division. I think the changes we made resulted in an organization that is stronger today than before the groups merged. Challenges in programs and infrastructure remain, but we are in a positive position today to address those challenges in the future.

I hope you all have a wonderful winter break and foresee positive changes that could lead to new opportunities in your future during the coming year.

MPA-11 Group Leader Andrew Dattelbaum

"I think the changes we made resulted in an organization that is stronger today than before the groups merged. Challenges in programs and infrastructure remain, but we are in a positive position today to address those challenges in the future."



MRS cont.

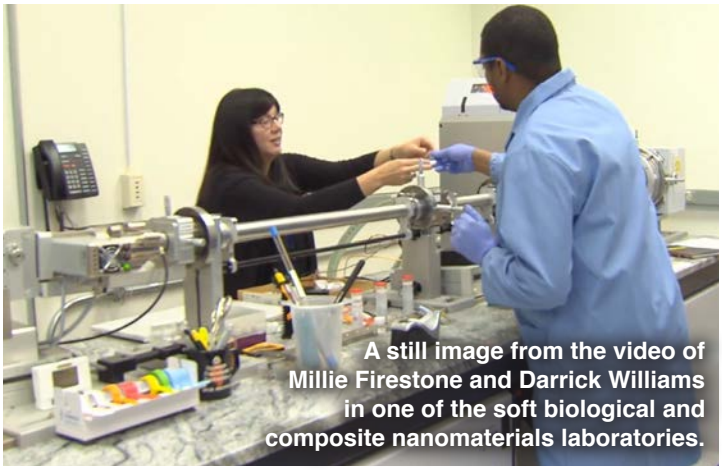
mos's additive manufacturing initiatives and the dynamic phase transformations studies enabling the materials of the future manufactured with this layer-by-layer printing technique.

Jennifer Hollingsworth, Nathan Mara, and Millie Firestone (Center for Integrated Nanotechnologies, MPA-CINT) explained the impact of their nanomaterials research to solve complex energy, medical, and information processing challenges.

Carpenter and Mara gave invited talks at the meeting. Carpenter presented recent research on "Process Design for Control of Strength and Thermal Stability in Bulk Nanolamellar Copper-Niobium Composites Fabricated via Accumulative Roll Bonding," and Mara on "Interface Facilitated Deformation in Bimetallic Nanolayered Composites."

Other invited speakers from MPA and MST were Nan Li (MPA-CINT) discussing "Measurement of Stress for Dislocation Motion through In Situ Nanoindentation;" Doan Nguyen (Condensed Matter and Magnet Science, MPA-CMMS), "Requirement of High Strength, High Conductivity Conductor and Reinforcement Materials for Ultra-High Field Pulsed Magnets;" Hou-Tong Chen (MPA-CINT), "Metasurfaces for Optical Antireflection and Polarization Manipulation;" Aiping Chen (MPA-CINT), "Role of Interfaces on Competing Interactions of Ferroic Films;" Vivien Zapf (MPA-CMMS), "Complex Spin Textures in Functional Magnetic Materials;" Yue Liu (Materials Science in Radiation and Dynamics Extremes, MST-8), "Strengthening Mechanisms of Highly Textured Cu/Co and Ag/Al Nanolayers with High Density Twins and Stacking Faults;" and Romain Perriot (MST-8), "The Role of Chemistry and Disorder on Ionic Conductivity in Pyrochlore." Enrique Martinez Saez (MST-8) co-chaired symposiums on microstructure evolution and mechanical properties in interface-dominated metallic materials and advanced atomistic algorithms in materials science.

See the video on YouTube: www.youtube.com/watch?v=h6SsjUBTVdw&index=31&list=PLGVe6BxyFHNX2RpSIgkJcuh502nXYLlrO.



A still image from the video of Millie Firestone and Darrick Williams in one of the soft biological and composite nanomaterials laboratories.

Laboratory's materials science experts survey functional nanomaterials for advanced materials journal

Focused on nanocomposites, the September special issue of *MRS Bulletin* features articles by Los Alamos materials researchers, emphasizing their take on approaches to design and control functionality through synthesis and characterization combined with simulation and modeling.

Center for Integrated Nanotechnologies Co-Director Quanxi Jia and Ce-Wen Nan (Tsinghua University, China) served as guest editors. In the lead article they noted that as the creation of new materials becomes more complex and expensive, nanocomposites are garnering increased attention due to their ability to achieve enhanced or emergent behavior by interfacing various known materials at the nanoscale or

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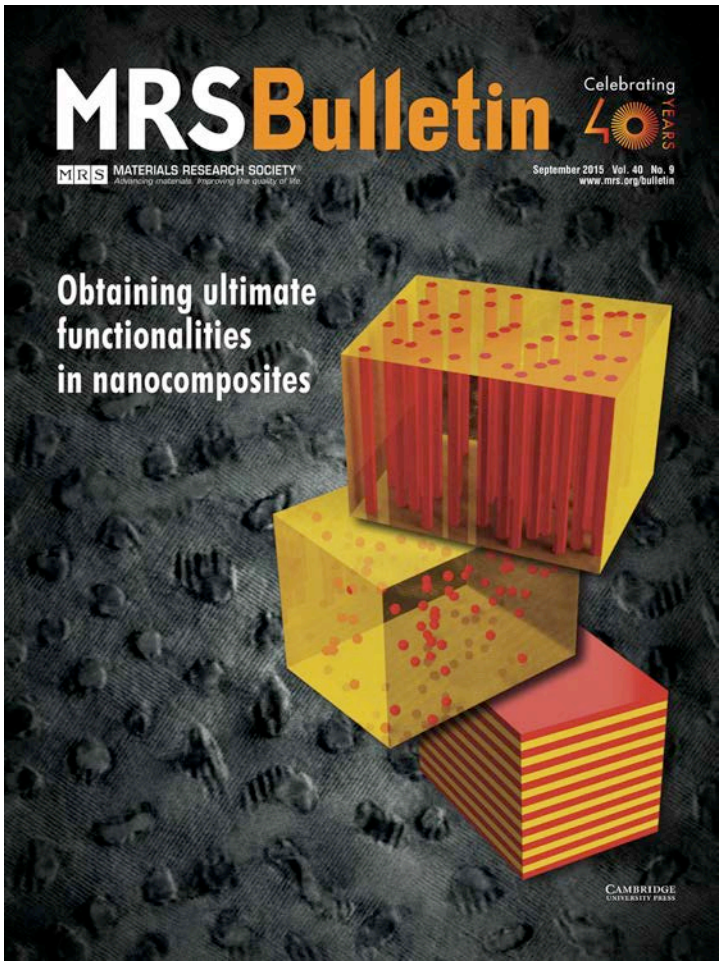


The September 2015 cover showcases work on nanoscale composites performed at Los Alamos. Aiping Chen (MPA-CINT) took the plan-view transmission electron microscope image of a vertically aligned nanocomposite (background) and Chris Sheehan (MPA-CINT) drew the schematic drawings of the most commonly investigated architectures of nanocomposites.

Advanced materials cont.

mesoscale. In "Obtaining ultimate functionalities in nanocomposites: Design, control, and fabrication," the authors conclude "it is hoped that the perspectives presented in this issue will encourage new thinking toward bringing scholars across multiple disciplines (materials science, chemistry, physics, engineering, computation) together."

The issue also features articles from Los Alamos researchers Millie Firestone, Steven Hayden, Jennifer Hollingsworth, and Han Htoon (all MPA-CINT) and Andrei Piryatinski (Physics of Condensed Matter and Complex Systems, T-4).

In "Greater than the sum: Synergy and emergent properties in nanoparticle-polymer composites," Firestone, Hayden, and Dale Huber (CINT, Sandia National Laboratories) offered recent examples illustrating possibilities for the rapidly changing field of nanocomposites, wherein introducing nanoparticles into a polymer results in novel or emergent properties.

In "When excitons and plasmons meet: Emerging function through synthesis and assembly," Hollingsworth, Htoon, Piryatinski, and collaborators reviewed strategies for "soft" chemical approaches to precision integration and assembly of emitter and plasmonic nanoantenna, important for the emerging aim of creating hybrid semiconductor-metal couples.

CINT, an Office of Science Nanoscale Science Research Center, is operated jointly by Los Alamos and Sandia National Laboratories. CINT is devoted to establishing the scientific principles that govern the design, performance, and integration of nanoscale materials. The work supports the Laboratory's national security missions and the Materials for the Future science pillar by creating materials with properties optimized for specific functions.

Reference: *MRS Bulletin* **40**, 9 (2015).

Technical contact: Quanxi Jia

Fuel cell team receives DOE funding for R&D project

With $3 million in new funding from the U.S. Department of Energy's Fuel Cell Technologies in the Office of Energy Efficiency and Renewable Energy, a Los Alamos scientific team will strive to overcome key challenges in developing alkaline anion exchange membranes for fuel cell applications over the next three years.

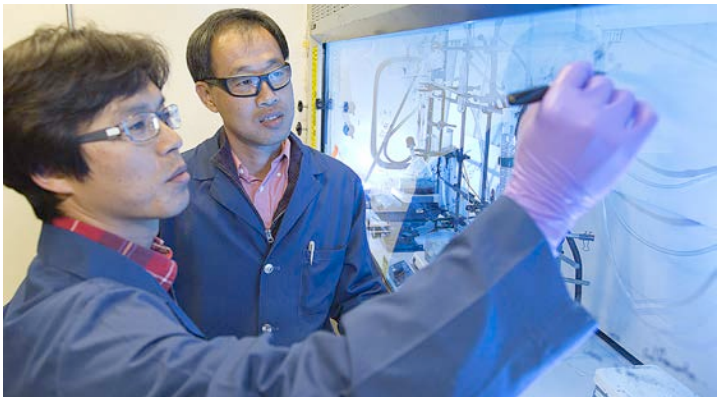
Los Alamos National Laboratory will partner with experts in hydrocarbon anion exchange membranes (Sandia National Laboratories and Rensselaer Polytechnic Institute), leaders in hydrogen oxidation reaction catalysts (Argonne National Laboratory), and an industrial membrane authority (Giner Inc). By combining these efforts with the Lab's long-standing expertise, the Los Alamos team intends to bring the anion exchange membrane fuel cell to commercial reality.

The thin material in alkaline anion exchange membranes poses a technical challenge as it disintegrates under high pH conditions. With stable alkaline membranes, automakers could replace expensive platinum catalysts with nonprecious-metal catalysts. Such materials also could revolutionize other energy applications like redox flow cell, air-metal batteries, and membrane-based water electrolysis.

Yu Seung Kim (MPA-11) will lead this new project titled, "Advanced Materials for Fully Integrated Membrane Electrode Assemblies in AEMFC."

The work supports the Lab's Energy Security missions and Materials for the Future science pillar.

Technical contact: Yu Seung Kim



In 2013, Kwan-Soo Lee (left), Yu Seung Kim (right), and their collaborators designed new anion exchange polymers, tested them in alkaline membrane water electrolysis, and demonstrated their record-high durability. The results led the sponsor of this work, DOE's Fuel Cell Technologies Office, to distinguish Los Alamos as having a core capability in alkaline membranes.

Eric Bauer, Hou-Tong Chen, Filip Ronning named 2015 APS Fellows

Materials Physics and Applications Division researchers Eric Bauer, Hou-Tong Chen, and Filip Ronning were recently elected as 2015 American Physical Society (APS) Fellows.

The selection as fellow recognizes exceptional contributions to the physics enterprise, such as outstanding physics research, important applications of physics, leadership in or service to physics, or significant contributions to physics education. Fellowship is a distinct honor signifying recognition by one's professional peers.

Eric Bauer (Condensed Matter and Magnet Science, MPA-CMMS) was cited for "outstanding and original contributions to the discovery and understanding of correlated electron systems, specifically for the study of complex electronic states hosted by correlated actinide and rare-earth materials." The APS Division of Materials Physics nominated him.

He received a PhD in physics from the University of California, San Diego and joined the Lab in 2002 as a director's postdoctoral researcher. As a postdoc Bauer earned three internal fellowship appointments. He was a Director's, Glenn T. Seaborg Institute, and Fredrick Reines fellow. He leads the Strongly Correlated Electron Team within MPA-CMMS. He synthesizes correlated f- and d-electron materials, including single crystal growth of lanthanide and actinide compounds by the molten-metal flux, Bridgman, vapor-transport and Czochralski techniques. He also investigates new unconventional superconductors, understanding quantum criticality and discovery of novel states of matter near quantum critical points, and examines the localized/itinerant crossover in the actinides through synthesis of single crystals of plutonium compounds and x-ray absorption spectroscopy techniques. He won a 2009 Presidential Early Career Award for Scientists and Engineers.

Hou-Tong Chen (Center for Integrated Nanotechnologies, MPA-CINT) was cited for "contributions to the development of active metamaterials and devices, and the development and understanding of few-layer metamaterials and metasurfaces, especially in the terahertz frequency range." The APS Division of Laser Science nominated him.

Chen earned a PhD in physics from Rensselaer Polytechnic Institute and joined the Lab as a postdoctoral researcher in 2005. He has made great advances in active and dynamic terahertz metamaterials. He studies metamaterials in the optical frequency range. Chen seeks to engineer and control the response of flat optics, which employ flat lenses made of metamaterials instead of conventional curved lenses. He also explores how integration of functional materials could make metamaterials for optoelectronic applications. Chen holds two patents and has received two Los Alamos Awards Program recognitions.

Filip Ronning (MPA-CMMS) was cited for "experimental contributions to understanding strongly correlated electron phenomena, particularly in cuprate and heavy-fermion systems." The APS Division of Condensed Matter Physics nominated him.

He received a PhD in physics from Stanford University and joined the Laboratory as a Reines Distinguished Postdoctoral Fellow in 2003. The Lab converted him to staff in 2006. His research investigates novel states of matter, including unconventional superconductors and strongly correlated topological materials. Ronning has more than 200 publications with more than 5,500 citations.

Celebrating service

Congratulations to the following MPA Division employees celebrating service anniversaries recently:

George Goff, MPA-11 ..... 10 years
Nathan Mara, MPA-CINT ..... 10 years
Erik Watkins, MPA-11 ..... 5 years
Jinkyoung Yoo, MPA-CINT ..... 5 years

Expanding career potential by learning from others' success

Getting business done at the Laboratory relies critically on Los Alamos's professional and administrative support staff.

A panel discussion sponsored by the Experimental Physical Sciences Directorate (EPS) aimed to leverage the experiences of successful support staff to help others in building their career opportunities at the Lab.

The Experimental Physical Sciences Directorate recently held a panel discussion on developing career opportunities for professional and administrative support staff.

Photo by Sandra Valdez, NIE-CS

"In EPS we want to create opportunities to enhance the professional development of our support staff. We hoped that hearing firsthand from others about their experiences would help grow awareness of different career paths possible at the Lab and important factors for career success," said Experimental Physical Sciences Associate Director Mary Hockaday. "These panelists shared important lessons—life lessons, really—about how to take control of those things you can control to keep your career on a positive track.

"The Lab is a system and its success depends on the contributions of everyone here," Hockaday said. "Enabling our staff members to reach their full potential is not only a good thing in itself, but also contributes to the success of the Laboratory and our national security mission."

The four panelists were Debbie Trujillo, a program manager for the National Security Office and Weapons Research Services; Charlene Martinez, a professional staff assistant for the Director's Office; Claudette Chavez, a technical project manager for Nuclear Materials Science; and Inez Valdez, of the Administrative Operations Team supporting Weapons Test Engineering. Their messages were conveyed in an overarching theme of positivity: look forward and not backward, treat others with respect, embrace and create opportunity, and always do your best.

HeadsUP!

Reminder: Call UPDATE hotline for latest on Lab operating status

When a snow storm or other wintry conditions are predicted, call the Lab's UPDATE hotline at 667-6622 or 1-877-723-4101 to hear the latest information on operating status before heading out to work. This information also will be put on the Lab's external/internal home page and provided to local television and radio stations, but your primary source for the Lab's current status is UPDATE.

With above average snowfall predicted for Northern New Mexico this winter, employees are urged to stay abreast of changing weather conditions, prepare vehicles for winter-driving, and adjust driving speed for road conditions—remember, speed limits are meant for dry roads, not roads covered in snow and ice.

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Materials Physics and Applications

Published by the Experimental Physical Sciences Directorate

To submit news items or for more information, contact Karen Kippen, ADEPS Communications, at 505-606-1822 or kkippen@lanl.gov.
To read past issues see www.lanl.gov/orgs/mpa/materialsmatter.shtml.

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